IN THE DRAWINGS:

Figure 7 has been modified to correct labeling errors and omissions in the following manner. These corrections do not alter the content of the specification or introduce new matter.

- Former numeric label 108 has been changed to 708. In the text of the specification, 108 is referred to as the back iron and 708 is referred to as the transducer housing. Former numeric label 108 incorrectly pointed to the transducer housing. Therefore changing the numeric label from 108 to 708 corrects this error.
- A numeric label 108 and lead line have been added to indicate the back iron 108.
- A numeric label 106 and lead line have been added to indicate the armature 106.
- A numeric label 100 and indicating line have been added to indicate the motor area 100.

REMARKS

In the Office Action of February 10, 2006 (the "Office Action"), Examiner rejected Claims 13-17, 19, 22, 25, 32 and 33 under 35 USC § 102(b) as being anticipated by U.S. Patent 4,628,907 (issued Dec. 16, 1986; hereinafter "Epley"). The remaining Claims 18, 20, 21, 23, 24, 30, 31 and 34-36 were objected to but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant respectfully traverses the rejections and submits the following arguments.

Rejection of Claim 13 under 35 U.S.C. §102(b)

Applicant respectfully asserts that the §102(b) rejection of independent Claim 13 is inappropriate. As written, Claim 13 states, "an output force of the variable reluctance motor is substantially linearly related to the input current." Firstly, Applicant will demonstrate that the mechanism of Epley will not produce an output force that is "substantially linearly" related to the input current. Applicant will also briefly describe how a substantially linear relationship between force and input current is achieved in an embodiment disclosed in Applicant's original specification. Secondly, to the extent that the noted rejection is maintained by Examiner, Applicant respectfully requests that the Examiner elucidate his reasoning behind his assertion that the output force of the motor in Epley is "substantially linearly" related to the input current.

The force generated by a typical variable reluctance motor, for any given position of stator and armature relative to each other and for a constant number of turns in a coil, is a function of the square of the current flowing through the coil. For example, as stated in Applicant's original application:

> Thus, for a two pole variable reluctance motor as represented, for instance, by paths 114 and 118, the output force generated may be given by, Equation 1:
>
> $$F = -\frac{1}{2}\left(\frac{NI}{\Re}\right)^2 \frac{d\Re}{dx}$$
>
> Where
>
> N = represents the number of turns on the coil;

I = represents the current (so that NI is the total current threading the coil core);

$\mathfrak{R}$ = represents the reluctance (resistance to magnetic flux), and

x = represents the displacement of the coil in the direction of motion.

While this type of motor is capable of producing large forces in a compact form factor, the resulting force is proportional to the square of the current, rather than linear with current. Original Application Pages 11-12.

This relationship between output force and current is well known. In the Standard Handbook for Electrical Engineers, 12th Edition, this relationship is described on page 2-20 as follows:

> When a differential motion *ds* m of a part of a circuit carrying a current *I* A change its self-inductance by a differential *dL* H, the mechanical force on that part of the circuit, in the direction of the motion, is

$$F = -\frac{1}{2} I^2 \frac{dL}{ds} \quad \text{newtons} \qquad (2\text{-}68)$$

See Standard Handbook for Electrical Engineers, 12th Edition, pages 2-19, 2-20, copies attached hereto in Appendix A.

In short, the mechanical force generated due to current flowing through a coil in a typical magnetic circuit will be related to the square of the current and therefore be non-linear. In such a typical magnetic circuit, the magnetic member is situated within the magnetic field produced when current is passed through the coil and that magnetic field acts directly on the magnetic member.

Turning to Figure 10 of Epley, an annular permanent magnet 136 produces a magnetic field which emanates from the north and south poles of the annular permanent magnet 136 and passes through the iron core 140. Note that the north and south poles are on opposite side surfaces of the annular permanent magnet 136. Thus, the magnetic field generated by the annular permanent magnet 136 will result in the attraction of the permanent magnet 148 (to which the output coupling element 150 is attached) toward the iron core 140. For any given position of the permanent magnet 148, the attractive force generated by the annular permanent magnet 136 will be constant.

The coil 134 of Epley Figure 10 is oriented in the same plane as the annular permanent magnet 136. This type of arrangement results in the magnetic field produced by the coil 134 when current is flowing through it acting on the permanent magnet 148 (to which the output coupling element 150 is attached) in a direction opposite of the magnetic field produced by the annular permanent magnet 136. This is a typical magnetic circuit where the magnetic member (permanent magnet 148) is situated within the magnetic field produced by the coil (coil 134). In this manner, when no current is applied, the permanent magnet 148 is attracted toward the iron core 140 and when current is applied to the coil 134, the permanent magnet 148 is repulsed away from the iron core 140 and thus the output coupling element 150 may be moved back and forth.

Since for any given position of the permanent magnet 148, the force generated on the permanent magnet 148 by the annular permanent magnet 136 will be constant and the force generated on the permanent magnet 148 by the passage of the current for the coil 134 will be related to the square of the current, the net force on the permanent magnet 148 will be related to the square of the current passing through the coil 134. Therefore in Epley, using the above equation 2-68, for a given differential motion *ds* m and the associated differential change in self-inductance *dL* H, the force will be related to the square of the current. Hence, the output force of the motor of Epley will not be "substantially linearly" related to the input current. For a given number of turns, N in the coil, the same result would follow if using the equation disclosed by Applicant in the original application.

Clearly, as demonstrated, a typical motor such as that found in Epley will produce an output force that is proportional to the square of the input current and hence non-linear. It is important to note that the motor of Epley is a traditional electromagnetic transducer that has no components that would cause the output force to be linearized with respect to input current.

Note that in the embodiment shown in Epley Figure 10, the permanent magnet 146 is simply situated in a similar fashion to the permanent magnet 148 but with the magnetic poles reversed. That is, instead of the north pole of the permanent magnet facing the iron core 140 as with permanent magnet 148, the south pole of the permanent magnet 146 is facing the iron core 140. This arrangement results in the permanent magnet 146 moving in the opposite direction of the permanent magnet 148 as a result of the forces from the annular permanent magnet 136 and the coil 134. The forces from the equal and opposite motion of the permanent magnet 146 relative to the permanent magnet 148 are used to help cancel vibrations. To this end, a counterpoise weight 152 is attached to the permanent magnet 146 to help reduce vibration.

In direct contrast, Applicant's invention is specifically configured to produce a linear relationship between the current applied to a coil and the force generated on an armature. By way of example only, in one embodiment of applicant's invention a magnetic member 104 is placed outside of the path of the magnetic field 118 produced by the drive coil 102 in a configuration specifically configured to produce a substantially linear relationship between the output force of the motor 100 and the input current to the coil 102. This configuration and accompanying formulae are described in detail in the original specification on pages 11 through 13 and Figure 1. To avoid repetition, those arguments will not be repeated here. However, Applicant will briefly review an important difference between Applicant's claimed embodiment and the embodiment shown in Epley Figure 10.

Unlike the embodiment shown in Epley Figure 10, the application of current in Applicant's claimed embodiment illustrated in Figure 1 does not directly cause the actuator to move in the manner typical of variable reluctance motors. It is the interaction of the magnetic field 118 created by the coil 102 with the magnetic field 114, 116 of the biasing magnet 104 which causes the actuator 106 to move. As described in the original specification, this interaction results in the force generated being substantially linear. Briefly, the magnetic field 118 of the coil 102 surrounds the magnetic field 114, 116 of the biasing magnet 104. When energized with current flowing in a particular direction, the magnetic field 118 of the coil 102 counters one portion of the permanent magnetic field 116 of the biasing magnet 104 while supplementing another portion of the permanent magnetic field 114 of the biasing magnet 104. An opposite effect can be achieved by flowing current through the coil 102 in the opposite direction. The combination of supplementing a magnetic field 114 in one direction while countering the magnetic field 116 in the opposite direction results in the motion of the armature 106.

In the foregoing, Applicant has demonstrated that the cited reference, Epley (used in the § 102(b) rejection of Applicant's Claim 13) does not produce an output force of the motor that is "substantially linearly" related to the input current. Furthermore, Applicant has demonstrated that Applicant's claimed embodiment does produce an output force of the motor that is "substantially linearly" related to the input current. If the foregoing arguments are not accepted by Examiner, Applicant respectfully requests that Examiner further elucidate the technical reasoning behind his assertion that the output force of Epley is "substantially linearly" related to the input current. This would allow Applicant to fully understand Examiner's position and respond accordingly.

Accordingly, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 13

be withdrawn. Since all other pending claims depend on Claim 13, Applicant also requests that the 35 U.S.C. §102(b) rejection of those claims be withdrawn. Should Examiner not be in agreement with the preceding argument, Applicant respectfully submits the following arguments with respect to the patentability of dependent claims.

Rejection of Claim 14 under 35 U.S.C. §102(b)

Applicant respectfully object to the characterization of elements by Examiner used in the rejection of Claim 14. In the rejection, Examiner stated that "element – 152 - is a stator." As explained above and in Epley at column 11, line 53, element 152 is a counterpoise weight designed to move in opposite direction from the output coupling element 150 to reduce vibration. Similarly, element 140 is not an armature. Element 140 is a stationary iron core. Epley column 11, line 25. Finally, element 146 is not a biasing magnet member, it is a permanent magnet 146 to which the counterpoise weight 152 is attached and it is not designed to bias any particular component in any particular direction, but to move in an opposite direction from the output coupling element 150 in an attempt to reduce vibrations of the system. Epley, column 11, line 63.

Applicant's Claim 14 specifically claims that the at least one magnetic member used to generate a biasing force generates that biasing force so that it acts on the armature in a substantially balanced manner. As stated in the original application, page 4, lines 13-18, this biasing force is present absent any current being applied to the drive coil of the motor. In the §102(b) rejection of Claim 14, Examiner has not stated how any magnetic member in Epley produces a biasing force that acts on the armature in a substantially balanced manner. There are three magnetic members disclosed in the embodiment of Epley Figure 10. They are the annular permanent magnet 136, permanent magnet 146, and permanent magnet 148. As discussed in detail above, annular permanent magnet 136 produces a non-balanced force on the permanent magnets 146, 148 to cause the permanent magnets 146, 148 to move inward toward the iron core 140. With respect to the interaction of the permanent magnets 146, 148 with each other, it is unclear from Epley whether or not the magnetic fields of the permanent magnets 146, 148 interact with each other. However, their orientation is such that if they did interact with each other there would be an attraction force between them and hence would not be interacting with each other in a substantially balanced manner. Therefore it is clear that no magnetic member of the embodiment shown in Figure 10 of Epley produces a biasing force acting on the armature in a substantially balanced manner

Accordingly, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 14 be withdrawn. Since rejected Claims 15-17, 19, 22, 25, 32 and 33 all depend on Claim 14, Applicant also requests that the 35 U.S.C. §102(b) rejection of those claims be withdrawn.

Rejection of Claim 15 under 35 U.S.C. §102(b)

Biocompatible is defined as compatibility with living tissue or a living system by not being toxic, injurious, or physiologically reactive and not causing immunological rejection. Merriam-Webster's 11th Collegiate Dictionary. Applicant's Claim 15 specifically claims "a biocompatible enclosure, enclosing the variable reluctance motor." There are two main aspects of this claim, the first being that the enclosure is biocompatible and the second is that it encloses the variable reluctance motor.

Applicant's original specification uses titanium as an example of a biocompatible material. Titanium is known to those skilled in the art as a material that is not toxic, injurious, or physiologically reactive and is therefore suitable for implantation within the body. As the embodiment claimed by Applicant is an implantable hearing aid transducer, biocompatibility is a significant concern.

In contrast, the embodiment of Epley Figure 10 is simply inserted into the ear canal. The motor of Epley Figure 10 contained within the housing 26' is not implanted within the body. It is simply inserted within the ear canal and is not exposed to the interior of the body. Therefore, there is no need for the embodiment of Figure 10 of Epley to contain a biocompatible enclosure enclosing the motor. Furthermore, there is no suggestion within Epley that the motor may be housed in a biocompatible enclosure or that the motor may be implanted within the body. Hence, Epley provides no motivation for use of a biocompatible enclosure for the motor. Indeed, nowhere within Epley is the term biocompatible used.

Furthermore, Examiner's assertion that plastic spool 138 of Epley Figure 10 is a biocompatible enclosure enclosing the motor is inaccurate. First, it is not stated within Epley whether or not the plastic spool 138 encloses any components. However, it is clear from Figure 10 that the plastic school 138 does not enclose several components of the motor such as the iron core 140, the permanent magnets 146, 148, the diaphragms 142, 144 and the counterpoise weight 152. Generally, it is Applicant's understanding that an iron core, absent some special coating that is not described in Epley, would generally not be considered to be biocompatible for implantation.

Therefore, Applicant respectfully objects to the characterization of the plastic spool 138 as biocompatible when biocompatibility is not an issue for the design of Epley and is not mentioned in the reference.

Second, it is clear that components of the motor of the embodiment of Epley Figure 10 are outside of the plastic spool 138. Such components include the iron core 140, the permanent magnets 146, 148, and the counterpoise weight 152. Since these motor components are outside of the plastic spool 138, Applicant respectfully asserts that plastic spool 138 does not enclose the variable reluctance motor and therefore does not contain all of the features of Applicant's Claim 15, making a § 102(b) rejection inappropriate.

If the foregoing arguments are not accepted by Examiner, Applicant respectfully requests that Examiner further elucidate the technical reasoning behind his assertion that the device of Epley is biocompatible. This would allow Applicant to fully understand Examiner's position and respond accordingly.

Accordingly, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 15 be withdrawn. Since Claim 16 depends on Claim 15, Applicant also requests that the 35 U.S.C. §102(b) rejection of Claim 16 be withdrawn.

Rejection of Claim 16 under 35 U.S.C. §102(b)

In regard to Claim 16, Applicant respectfully reasserts the assertion that the embodiment of Epley Figure 10 does not contain any biocompatible enclosures.

Applicant also respectfully asserts that a reasonable interpretation of the phrase of Claim 16 stating, "a first biocompatible enclosure enclosing the armature and a second biocompatible enclosure enclosing the stator" requires that, for the embodiment claimed in Claim 16, the first biocompatible enclosure does not enclose the stator and that the second biocompatible enclosure does not enclose the armature. To interpret the quoted phrase of Claim 16 otherwise would go against common understanding and plain meaning of the phrase.

In rejecting Claim 16, Examiner states, "spool 138 is a first biocompatible enclosure enclosing the armature and element 26' encloses the stator." However, element 26' surrounds the entire motor of Epley Figure 10, including the stator and armature. To claim such a configuration, language such as "a first biocompatible enclosure enclosing the armature and a second biocompatible enclosure enclosing the armature and stator" would have to be used. Since such language was not

used by Applicant, Claim 16 should be interpreted to mean that the first biocompatible enclosure encloses the armature but does not enclose the stator and the second biocompatible enclosure encloses the stator but does not enclose the armature. No such configuration is disclosed in Epley.

Additionally, Applicant notes that the plastic spool 138 does not enclose an armature in the embodiment of Figure 10 of Epley. "Armature" is generally used to describe moving parts in an electric motor and the plastic spool 138 of Figure 10 of Epley does not enclose any moving parts.

Accordingly, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 16 be withdrawn.

Rejection of Claim 22 under 35 U.S.C. §102(b)

Applicant's Claim 22 specifically states that at least one magnetic member be located substantially outside of the path traveled by the electromagnetic field induced by drive coil.

Applicant respectfully asserts that Examiner's characterization of element 146 in the embodiment of Figure 10 of Epley is incorrect in that element 146 is not substantially outside the path traveled by the electromagnetic field induced by the drive coil. In fact, the very functionality of the device of Figure 10 of Epley requires that element 146 be within the electromagnetic field induced by the drive coil 134. As stated in Epley, "however, it should be noted that because of the polarity of the permanent magnets 146 and 148, the diaphragm 142 and counterpoise weight 152 are deflected in a direction opposite to the movement of the transducer output coupling element 150 and its associated diaphragm 144, thereby functioning as a counterpoise to reduce internal vibration." Epley column 11, lines 57-63. Permanent magnet 146 is permanently attached to diaphragm 142 and counterpoise weight 152. For the counterpoise weight 152 to move as a result of current flowing through the coil 134, the permanent magnet 146 must be within the path traveled by the electromagnetic field induced by the drive coil 134. If the permanent magnet 146 were outside of the field induced by the drive coil 134 there would be no movement of the counterpoise weight 152 attached to the permanent magnet 146 and no vibration reduction aspect.

Accordingly, since no magnetic member of Epley is located substantially outside of the path traveled by the electromagnetic field induced by the at least one drive coil, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 22 be withdrawn.

Rejection of Claim 25 under 35 U.S.C. §102(b)

As discussed previously with respect to Claim 13, the annular permanent magnet 136 of the embodiment of Epley Figure 10 produces a magnetic field that provides a constant force acting on the permanent magnets 146 and 148 which draws those permanent magnets 146 and 148 toward the iron core 140. Also as previously discussed, the application of current to the coil 134 causes the permanent magnets 146 and 148 to move away from the iron core 140. In this way, the application of current to the coil 134 can cause the permanent magnets 146 and 148 to move away from the iron core 140 and any subsequent removal of current from the coil 134 would result in the permanent magnets 146 and 148 moving back toward the iron core 140 due to the force imparted by the magnetic field of the annular permanent magnet 136. It is also important to note that the diaphragms 142 and 144 also provide a force that may be counter to the force imparted by the magnetic field of the coil 134. In this way, application of current in a single direction and the subsequent removal of that current will result in the output coupling element 150 moving back and forth.

Therefore, contrary to Examiner's statement that "the current must currently alternate to drive the actuator for the device to function as a hearing aid" the device of Epley Figure 10 is capable of operating without alternating current. Epley contains no discussion of alternating current used to drive the embodiment shown in Epley Figure 10. Accordingly, Applicant respectfully requests that the 35 U.S.C. §102(b) rejection of Claim 25 be withdrawn.

Conclusion

Based upon the foregoing, Applicant believes that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution and/or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

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